The Canadian Entomologist

LXV ORILLIA, JUNE, 1933 No. 6

NOTES ON THE EARLY STAGES OF CERTAIN NOCTUID AND GEOMETRID SPECIES*

BY J. MCDUNNOUGH

Ottawa, Ontario.

CUCULLIINAE

Oncocnemis saundersiana Grt. The young larvae of this species were first found at Bobcaygeon, Ont., in June, 1931, feeding within the blossoms of a *Pentstemon* sp. but died before reaching maturity. At the same time and place in 1932 a number of more fully grown larvae were secured, either feeding on the blossoms or resting flat against the main stem of the plant; the larvae are smooth, slender and of a pale green color, variably suffused with a pinkish shade, exactly matching the *Pentstemon* blossoms, and at times they may be entirely pink, especially in those instances where the caterpillar is resting on the flower-heads. Pupation takes place in the earth and the moth emerges in late August.

The *pupa* is smooth, dull brown in color and in general much like Mosher's figure of *Cirphis unipuncta* (1916, Classification of Lepidoptera based on Pupal Characters, Pl. XXVII, fig. 102) as far as the head and thoracic segments and their appendages are concerned; that is to say the wing-sheaths extend nearly to the posterior margin of abdominal segment IV; the maxillae reach the caudal margin of the wings, the mesothoracic legs and antennae being slightly shorter; labial palpi are present as well as prothoracic coxae, the latter being broader than in the above-mentioned figure; only the prothoracic legs extend cephalad to the eye-pieces. The abdominal segments offer certain characters not mentioned by Mosher as pertaining to the Cuculliinae, due primarily to lack of material for study in this subfamily at the time. The first four segments are smooth; segments V-VII show on their anterior portions, cephalad of the spiracle, a ring of very shallow pits encircling the entire segment; these pits are arranged roughly in a single row with their anterior half (and sometimes the entire pit) bordered by a raised blackish edge. The cremaster is improminent, blunt at end, and shows *no sign of either curved or straight setae;* it is covered with a fine network of slightly raised blackish rugae, heaviest on the dorsal side and apparently better developed in the male than in the female. The entire lack of cremaster hooks makes the key to subfamilies given by Mosher (*op. cit.* p. 108) impossible to use; possibly the addition under Captions *b* and *cc* of the words "or without setae" should be made as in other respects the subfamily characters given coincide with those found in the present species.

GEOMETRINAE.

Drepanulatrix liberaria Wlk. Very young larvae of this species (possibly in 1st instar) were swept from bushes of *Ceanothus americanus* at Bobcaygeon, Ont., on June 1, 1932. Later attempts to secure larvae were unsuccessful and it seems probable that in more advanced stages the caterpillar conceals itself

*Contribution from the Division of Systematic Entomology, Entomological Branch, Department of Agriculture, Ottawa.

B & Z LIBRARY

in the daytime among the thick growth of twigs and leaves and cannot easily be disturbed.

When young the larvae are pale green, gradually attaining through the successive stages the maculation of mature specimens. The adult caterpillar is either brown or green, a color variation already noted by Dyar in the larvae of several of the Western species of this genus, which incidentally are all *Ceanothus*-feeders. The head is rather small, flat, with well rounded, imprommnent epicranial vertices; the color is pale, with considerable brown striation on the apical section of each epicranial lobe. The abdomen is smooth, cylindrical, marked with four pale yellowish, longitudinal, fine stripes situated dorsally, subdorsally (laterad of tubercle I), laterally (just dorsad of tubercle III) and in the spiracular area; of these the subdorsal and spiracular stripes are the broadest; the area between the various lines and below the spiracles is also slightly and irregularly marked with pale strigulations. Ventrally there is a fine pale medio-ventral line and a pair of similar subventral ones. The tubercles are very minute, blackish, each with a single short seta. Prothoracic plate scarcely differentiated from the rest of the abdomen; anal plate pale, roughly triangular with sparse brown strigulations. Legs and prolegs pale, the latter with rather strong, chitinous, lateral plates, bearing setae. Length 30 mm.

Pupation takes place in a rather loose cocoon on the surface of the ground about the end of June. The pupa is shiny brown and falls into Group A of Mosher's classification (*op. cit.* pp. 127/8). There appears to be no epicranial suture but a frontoclypeal suture is at least indicated; a narrow portion of the prothoracic femora are exposed and the labrum and labial palpi are clearly defined as small triangular areas below the clypeus; the wing-cases extend almost to the caudal margin of the fourth abdominal segment and are faintly strigulate with weak furrows, especially along margins; the antennae are equal to the wings in length whilst the maxillae and mesothoracic legs are very slightly shorter and the prothoracic legs about three-quarters the length of those of the mesothorax. Dorsally the thoracic segments are very faintly sculptured, the mesothoracic spiracle showing a large, kidney-shaped, blackish prominence on its caudal margin. Abdominal segments I-IV are heavily pitted dorsally over their entire surface with the exception of the marginal areas; on the posterior segments similar pitting occurs but tends to be confined to the anterior half of each segment and extends in a narrower band across the entire ventral surface on the anterior portion of each of segments V-VIII. The ninth and tenth segments are largely smooth and the tenth shows ventrally rather prominent lateral bulges between which in the median area are several faint longitudinal furrows and above which on each side, in an area corresponding to the spiracular area of previous segments, is a large, deep, oval pit, extending obliquely inwards and visible from a dorsal view. The cremaster is conical, irregularly striate, and is furnished with two apical hooked setae; dorsolaterally is a row of three much shorter setae with somewhat club-shaped tips. The abdominal spiracles are small, narrowly oval and situated in slight depressions, but without furrows. In Mosher's generic key to Group A the species falls into section *aa*, caption *b*.

Adults began to merge from the above pupae in the second week of September and continued at intervals during the whole month. There is a great deal of individual as well as sexual variability; in general the males are of a

rather bright brown color, marked and suffused with blackish whereas the females show a light olive ground-color with variable pinkish suffusion in the median and terminal areas.

Melanolophia canadaria Gn. A female of this species, captured at Bobcaygeon, Ont., on June 5th, laid a number of pale green eggs, glued in an irregular manner to the side of the box, during the following week; these turned shortly reddish and the young larvae hatched in about ten days. After the trial of a number of different food-plants, basswood *(Tilia)* was selected as the most acceptable one, although both oak and *Myrica* leaves were eaten readily; on this food-plant the larvae thrived excellently.

The young larvae are pale green, smooth, cylindrical, with faint ruddy tinges on the head. After the third moult longitudinal subdorsal and stigmatal whitish bands begin to show on the abdomen; these become plainer and more yellowish in color as the larva grows and are quite distinct in the next instar; there are also at times traces of purplish spotting along the spiracular band, generally in the posterior portion of a segment, and a broken purple-black dorsal line, most often only indicated by spots on the posterior margin of each segment. The body remains smooth with very broad anal clasper and the tubercles are very minute, blackish. The head is pale greenish with slight brown shades above the ocelli and brown sprinkling in the apical region of each epicranial lobe, which is moderately rounded.

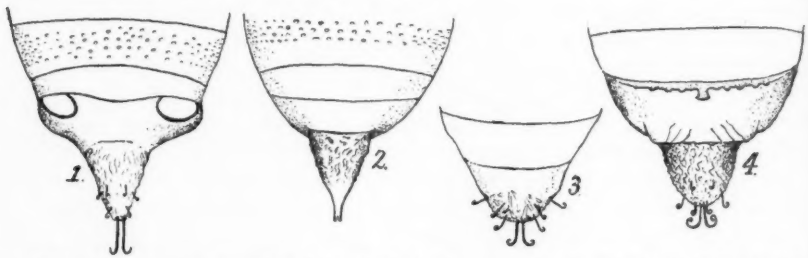
When full grown the larva has a rather flat, oblique, pale greenish head. On the abdomen the subdorsal yellowish bands have broadened leaving only a small portion of the original green ground-color in the lateral areas; these yellowish bands are separated dorsally by a broken, purple-brown medio-dorsal line which still tends to be reduced to mere dots on the posterior margins of the segments. The spiracular yellow stripe becomes suffused with purplish-red, relieved by black-brown dashes on its dorsal edge. The entire ventral area is frequently suffused with purplish brown; in some specimens, however, this suffusion is not so extended and sections of each segment show the greenish coloration of the lateral areas. Length 30-35 mm.

Pupation takes place in the ground. After two or three weeks the pupae were all removed from the earth and placed in moss in the expectation that they would hibernate; however, half a dozen specimens emerged in late August and early September and an examination of the remaining pupae showed that the moth had fully formed under the pupal shell but had died before emergence.

The *pupa* is brown, shining, the wing sheaths being paler in color than the abdominal segments. In structural details of the head appendages it differs somewhat from the pupa of the preceding species; an epicranial suture cannot definitely be said to be present, although there seem to be indications of one in a short, oblique furrow jutting inward from near the cephalic angle of the antenna; there is no trace of the prothoracic femora and the mesothoracic legs are very slightly shorter than the maxillae which equal the antennae in length. The first two thoracic segments are finely striate, the front is somewhat rugulose as well as striate in its caudal section; the wing-sheaths are very faintly striate; the metathoracic tergite is pitted; the mesothoracic spiracle is impromínent. Abdominal segments I-III are pitted over their entire dorsal surface but IV and V are nearly smooth dorsally with the exception of the anterior margin of IV,

which shows pits; of the remaining segments VI-VIII are pitted both dorsally and ventrally in their anterior one-half to two-thirds, whilst the posterior segments are practically smooth and blackish in color. There is a curved spiraclar furrow, strongly chitinized cephalad of the fifth abdominal spiracle. The cremaster is well-developed, conical and rather heavily rugose in the basal half; it is drawn out apically into a blunt point which shows slight traces of bifurcation at extreme apex; *there are no cremastral hooks*; at its base ventrally is a rather deep depression but there is no trace of the lateral pits of the previous species.

The species falls into Mosher's group D, if we consider the cremaster to be apically bifurcate and will fall in the same section as *Ectropis* Hbn. and *Anavitrinella* McD. (*Cleora* of Mosher).



Posterior abdominal segments (dorsal view) of pupa of 1. *Drepanulatrix liberaria* Wlk.; 2. *Melanolophia canadaria* Gn.; 3. *Plagodis intermediaria* B. & McD.; 4. *Xanthotype urticaria* Swett.

Plagodis intermediaria B. & McD. A female of this species, beaten out of a basswood *(Tilia)* tree at Bobcaygeon, Ont., on June 17, 1932, laid a few eggs during the following week. These, at first pale yellowish, soon turned rather bright reddish and the young larvae hatched in about ten days, feeding well on basswood leaves.

The larva in the first two instars is smooth, cylindrical, pale green, with a pale reddish head. In the third instar the abdomen becomes more or less strongly suffused with purplish brown on the anterior and posterior segments with traces of longitudinal waved whitish lines in the dorsal region. The prolegs are black; anal clasper yellowish; tubercles minute, blackish. Considerable change takes place in the fourth instar; the head is now light red-brown with purplish shading on the apices of the epicranial lobes. The abdomen is rather dull green with purplish shading as in previous instar and traces of pale longitudinal lines on the tergites, most distinct in the subspiracular area. Dorsally on the seventh segment there is a flat transverse wart, purple-black in color. The ventral area is rather dark with median broken band and submedian lines. The anal claspers remain pale.

In the final instar (full grown) the head is rather small, vertical, pale gray, heavily mottled with blackish and when at rest generally retracted into the prothorax; the thoracic segments are much thickened as compared with the anterior abdominal ones and when the larva is quiescent assume a very characteristic knob-like appearance. The prothorax is heavily black-shaded and generally shows a narrow whitish anterior and posterior border-line; the mesothorax has a dark, dorsal, transverse band behind its highest elevation; there are frequently blackish lateral spots on the metathorax and first abdominal segment and traces of longi-

tudinal pale lines laterally, fairly distinct on prothorax and continued caudad as far as the seventh abdominal segment. The first six abdominal segments are smooth, cylindrical, light gray, strongly suffused with purple-brown, palest in the area before the dorsal hump of the seventh segment; this hump is quite prominent, bordered posteriorly with reddish brown, marbled with black. Posterior segments shaded with red-brown dorsally and with slight blackish markings; anal clasper pale purplish. Tubercles minute, blackish. Prolegs blackish. The larva at rest, with its knob-like thorax and dorsal hump of the seventh abdominal segment and the smooth cylindrical intermediate section, presents a very striking appearance, especially as it stands stiffly out from the twig grasped by its anal claspers.

Pupation takes place in a rather tough cocoon formed of debris (in the present instance among scraps of soft paper). A single female moth merged on October 1st, the remaining pupae hibernating and emerging early in the spring of 1933; it seems probable that the species is single-brooded under natural conditions, in Canada at least.

The pupa is light brown with greenish wing-cases, and greenish tinges over thoracic and cephalic sections. The prothoracic femora are not indicated and both the maxillae and mesothoracic legs are slightly shorter than the antennae which reach to the caudal margin of the wing-sheaths. There seems to be some indication of an epicranial suture but there is no definite demarcation of the vertex (or head-piece), conditions, in fact, being much as in the preceding species. The thoracic segments are finely transversely striate, the head capsule faintly rugulose and partially striate and the wing-sheaths irregularly striate. The metathoracic spiracle shows on its caudal margin a raised narrowly transversely oval tubercle, covered with fine brown hair. Fine pitting covers the dorsum of abdominal segments I-V and the ventral area of V; on VI and VII this pitting is confined to the anterior half of both surfaces and is lacking on the remaining segments. The cremaster is poorly developed, rather broadly rounded apically, rugulose, with a basal depression on ventral side; it is armed with two apical curved hooks and three lateral ones on each side, the apical hooks being somewhat longer and stouter than the lateral ones but not very noticeably so. There are no spiracular furrows nor dorsal furrow between segments IX and X.

The bred series before me (four males, three females) does not correspond exactly with topotypical Ottawa *intermediaria*, being somewhat larger, primaries with more olive-green suffusion and secondaries with postmedian line less developed and only distinct above anal angle. In other respects, however, notably the distinct discal dot or streak of primaries, the specimens agree quite well and I am placing them under this name for the present.

Xanthotype urticaria Swett. A larva of this species was found feeding on dogwood (*Cornus* sp.) and two pupae were discovered in slight cocoons between leaves of *Myrica* at Bobcaygeon, Ont. As compared with the entirely pale green larva of *sospeta* Dru. (*crocataria* Fabr.) which also feeds on *Cornus* as well as *Thalictrum*, *urticaria* shows a considerable amount of pale gray suffusion. The head is very flat; the body slender and cylindrical with two small conical dorsal warts on the next to last segment; color pale grayish, somewhat mottled and streaked with brownish and with a pale whitish spiracular band which separates the darker dorsal area from the paler ventral one. At rest it attaches itself to a

twig by its anal claspers and juts out, perfectly straight and rigid, at an angle of about 45°, scarcely distinguishable from its surroundings.

The pupa has the same characters as that of *sospeta* which has been treated of by Mosher (*op. cit.* p. 129); I might add that the mesothoracic spiracle is much as in *Plagodis* and that besides the dorsal furrow between segments IX and X, there is a large lateral, shallow depression with raised edges, disconnected with the dorsal furrow, and extending obliquely dorsad across almost the entire tenth segment in the spiracular region.

DISTRIBUTION OF POLISTES IN CANADA, WITH NOTES ON THE GENUS (HYMENOP.)*

BY C. LYNN HAYWARD,

Brigham Young University, Provo, Utah.

Through the courtesy of Dr. J. McDunnough of the Division of Systematic Entomology, Canada Department of Agriculture, I have had the privilege of examining a series of *Polistes* from several of the Southern Canadian Provinces. It is the purpose of this paper to discuss the distribution of this genus as shown by the collection and to present some comments on the characteristics of the species studied, especially as they relate to the United States forms.

The writer wishes to express appreciation to Dr. Vasco M. Tanner, Department of Zoology, Brigham Young University, for his helpful criticism of the manuscript, and to Dr. J. Bequaert, Harvard Medical School, for verifying some of the determinations.

All of the Canadian specimens belong to the common North American *Polistes fuscatus* (Fabricius) which is distributed in its various color forms throughout a large part of the continent. The males of this species are distinctly characterized by the epistomal (fronto-clypeal) suture being remote, often by a narrow margin, from the compound eye, and by the presence of a small tubercle on the center of the terminal abdominal sternum. The distinguishing characters of the females are less definite, but the abdomen is considerably broader than that of the other common North American species, *Polistes canadensis* Linnaeus. This latter species is confined to more southern regions and apparently does not reach Canada at all. It may be of interest to note in this connection that the typical *P. canadensis* Linn. is found in Brazil (Bequaert, Bull. Brooklyn Ent. Soc., Vol. XXIII, p. 56, 1928).

In the material studied, the writer was able to recognize only three color varieties as follows.: *Polistes fuscatus* (Fabricius), *Polistes fuscatus* var. *pallipes* Lepeletier, and *Polistes fuscatus* var. *variatus* (Cresson). None of these forms is exactly typical for the varieties as they are found in the United States. A few specimens of *P. fuscatus* from Ontario conform rather closely to typical specimens from the Eastern United States. The typical *fuscatus*, however, is entirely fuscous and black with no yellow whatever; while the specimens from Canada all have yellow bordering the pronotum and metanotum, yellow stripes on the propodeum, and yellow bordering the first and second terga. These forms appear to be transitional between the typical *fuscatus* and the variety *pallipes*.

*Contribution from the Department of Zoology and Entomology, Brigham Young University, Provo, Utah, No. 48.

Many of the specimens from Quebec and Southeastern Ontario are like the familiar *P. f. pallipes* of New England; but the typical *pallipes* is almost entirely black with a narrow border of yellow on the first abdominal tergum, while the Canadian forms frequently have yellow borders on all of the abdominal terga as well as yellow stripes on the propodeum. Many of them also have small to medium sized spots of yellow on the second abdominal terga.

The *Polistes* of Western Canada are apparently transitional between the Mid-western *P. f. variatus* and the California *P. f. aurifer*. They are much darker than the typical *aurifer* and the yellow markings are correspondingly more limited in extent; but many of the specimens lack the ferruginous or fuscous border that surrounds the yellow spots of the second abdominal terga in typical *variatus*. They are, however, in the opinion of the writer, much closer to *variatus* and should be placed with that group until future studies may justify a new variety name.

A study of any considerable number of *Polistes*, such as the series from Canada, illustrates the complexity of their proper segregation into color varieties. Such specimens as I have been able to study from nearly every section of America north of Mexico show an almost continuous series of variations from the almost black *P. f. pallipes* of the East to the nearly pure yellow *P. f. flavus* of the Southwestern Deserts. These variations seem to run along two lines: First, in the extent of ferruginous or brown markings over the black; and second, in the extent of yellow markings over the black. The extremes of these series are easily and distinctly separated; but the limitation of some of the intermediate forms that are closely associated and intergraded somewhat, seems to be an almost hopeless task.

A study of a large series of nesting colonies may tend to show us the range of individual variation within a nest and accordingly help to clarify the problem for a given locality. Such a study will probably result in the multiplication of color varieties especially as they are now grouped under the variety *variatus*, and may also result in the "lumping" of other familiar forms.

While the coloration in *Polistes fuscatus* is extremely variable, the writer (1931) has found the morphological characteristics of the species very stable. Those morphological characters mentioned above as well as a number of others seem to be perfectly reliable in separating any of the several thousand specimens that I have been able to study. It is likewise remarkable that even the coloration in the well defined *P. canadensis* of the Southern United States is quite stable and the color varieties are usually distinct.

The above observations indicate that large collections, especially of nesting colonies from all parts of America must be carefully studied before it is possible to arrive at any accurate conclusions as to the taxonomical relationships of these interesting forms. It is also apparent that it will probably never be possible to assign every random specimen to its natural color variety.

The genus *Polistes*, according to the records at the disposal of the writer, is confined largely to the southern portions of the Canadian Provinces bordering the United States. Mr. Ferris Neave of the University of Manitoba informs me (letter, December 12, 1931) that so far as he knows, *Polistes* is not found as far north in Manitoba as Winnipeg. I have examined specimens from British

Columbia, Alberta, Ontario, and Quebec, the localities of which are given in more detail below. No specimens from Saskatchewan or Manitoba were available to me, although I feel sure that *Polistes* may be found in the southern portions of these provinces. Stevens, however, states (Ent. News, Vol. XXVIII, p. 420, 1917) that the genus is rare in North Dakota.

The distribution of *Polistes* in Canada conforms rather well with its altitudinal distribution in the Western United States. In Utah and Colorado the genus does not seem to be common, if it occurs at all, above 7,000 feet elevation or the lower limits of the Canadian Zone. It is decidedly less boreal than the rather closely related *Vespula*.

The distribution by localities as indicated in the collection studied is as follows:

Polistes fuscatus (Fabricius)

ONTARIO: Chatham, three females (Sladen); Grimsby, two females.

Polistes fuscatus var. **pallipes** Lep.

QUEBEC.: Fairy Lake, two females; Hemmingford, six females and one male (Armstrong); Chelsea, three males; Kirk's Ferry, two females and one male; Hull, four females; Ft. Coulonge, three males and six females (Beaulne); Aylmer, Queen's Park, thirty-six males and females (Hutchings); St. Jerome, one female; Kingsmere, one female; Covey Hill, seven females and two males (Petch).

ONTARIO: Rostrevor, four females (Gibson); Harrisburg, one female, one male; Grimsby, eleven males and females; Toronto, four females and two males; Mer bleue, one female; Hastings Co., one male and one female; Brittania, one male; Trenton, one male and one female (Evans); Sudbury, two males and two females; Ottawa, thirty-two males and females (Gibson, Beaulne, Sladen).

Polistes fuscatus var. **variatus** (Cresson).

BRITISH COLUMBIA: Agassiz, two males; Chase, one female; Chilcotin, one female; Ft. Steele, two females (Anderson); Goldstream, one female; Kaslo, twenty-three males and females (Cockle); Kelowna, one male; Keremeos, three females (Garrett); Lillooet, six females; Okanagan, one female (Wilson); Oliver, seven females (Garrett); Penticton, four females; Royal Oak, one female; Salmon Arm, three males and one female; Similkameen, one female; Summerland, one male and one female; Trout Creek, four males; Vernon, thirty-six males and females (Gillespie, Ruhmann); Victoria, six males and females (Treherne); Vasseaux, two females; Wellington, one female.

ALBERTA: Medicine Hat, one male.

ONTARIO: Nelles Corner, one male.

REFERENCES.

Enteman, W. M. 1904. Coloration in Polistes. Carnegie Institution of Washington, Publ. No. 19, pp. 1-88.

Hayward, C. L. 1931. A Morphological and Systematical Study of Utah Polistes. MS, Brigham Young University, Provo, Utah

1932. The Paper Wasps of Utah. Proc. Utah Acad. Sci., Vol. IX, pp. 85-101.

Lewis, H. W. 1897. Vespinae of the United States and Canada. Trans. Amer. Ent. Soc., Vol. XXIV, pp. 169-192.

AN ATTACK ON A CICADA BY POLISTES RUBIGINOSUS

BY HAROLD O'BYRNE,
Webster Groves, Missouri.

According to Ashmead (1896) and others, the wasps belonging to the genus *Polistes* usually feed their young chewed-up fragments of lepidopterous larvae. However, Riley (1873) mentions *P. rubiginosus* Lept. as one of the natural enemies of the Colorado potato beetle, *Leptinotarsa decemlineata* Say, whose larvae it carries to its nest. A varied diet is therefore to be expected in these wasps. Nevertheless, I was very much surprised when I came across a *rubiginosus* engaged in a violent struggle with a large cicada (identified as *Tibicen auletes* Germ. by Mr. William T. Davis), at Ranken, Missouri, on July 19, 1932.

The cicada was on the ground, lying on its back, while the wasp straddled it and attempted to bite off it legs. The cicada repeatedly knocked its assailant off, but the wasp returned each time, and it finally succeeded in biting off five of its victim's legs. As the cicada did not lessen its struggles after this mutilation, the wasp at length became discouraged and departed; it flew high in the air and did not return.

I did not see the wasp catch the cicada, nor could I learn whether it attacked the creature to obtain food for itself, as *Vespa crabro* Linn. has been observed doing (Davis, 1925), or to provide for its young, as is the usual behavior of *Sphecius speciosus* Dru. Whatever its purpose may have been, for a *Polistes* wasp to attack a cicada is very exceptional behavior, and I am therefore putting this incident on record.

REFERENCES.

Ashmead, Wm. H. The habits of aculeate Hymenoptera—IV. Psyche, 7:75, 1896.

Davis, Wm. T. *Cicada tibicen*, a South American species, with records and descriptions of North American cicadas. Journ. N. Y. Ent. Soc., xxxiii:50, Mar. 1925.

Riley, C. V. Fifth Annual Rept., State Entomologist of Mo.:53-54, 1873.

NEW SPECIES OF NORTH AMERICAN SCARABAEIDAE (COLEOP.)

BY R. E. BARRETT,
Saticoy, California.

Listrochelus duncani n. sp.

Oblong, rather slender, castaneous, elytra pruinose, pronotum and head rufo-testaceous. Head cribrately punctured except behind the distinct transverse carina on the vertex where there are a number of distinct punctures at the sides separated by their own diameters, clypeal suture slightly impressed, clypeal margin slightly reflexed, a few short erect setae immediately anterior to the carina. Pronotum shining, twice as wide as long, wider at base than apex, lateral margins obtusely subangulate behind the middle and coarsely crenulate and fimbriate, surface rather finely punctate with punctures separated by two or three times their own diameters, devoid of setae. Elytra sparsely punctate with a few short erect setae, surface pruinose, sutural costa feeble, margin fimbriate with short setae. Body beneath minutely punctate, abdomen clothed with very short setae, thoracic sternites densely pilose.

Male. Club of antennae longer than funicle and paler. Tarsal claws all similar, each with a small tooth at middle, apical portion smooth, basal minutely serrulate. Last three abdominal segments flattened, not concave at middle. Pygidium truncate, shining, sparsely punctate. Posterior tarsi equal in length to the tibiae. Length 12 mm.

Female. Unknown.

Type with label reading Chiricahua Mts., Arizona, August 2, 1932.

This species should be placed in our lists between *knausi* Schaeffer and *timidus* Horn. It may be distinguished from *knausi* by the strong transverse carina on the head and the shape of the fifth abdominal segment of the male and from *timidus* by size and the side margins being coarsely crenulate and fimbriate.

Collected by Mr. Douglas K. Duncan of Globe, Arizona, to whom the species is dedicated.

Phobetus Lec.

Considerable confusion exists in the literature regarding some of the characters found in this genus. The small reflexed uncus on the inner side of the middle tibiae at the apex is present only in the male. Females seem to be infrequently taken. Casey from his remarks on the genus had only seen the male. I have before me 182 specimens, 33 being females. A long series of specimens from Sequoia National Park, California, taken in May, show considerable variation in color but are identical with regards to the oedeagus. A number of these specimens fit the description of *centralis* Casey, others are typical *comatus* Lec., while still others are intermediate. As *centralis* Casey is erected primarily on color, I prefer to regard it as a synonym until examination is made of the oedeagus. Specimens are at hand from Corvallis, Oregon, which show slight differences in the oedeagus, but I am unwilling to consider them distinct from *comatus* Lec.

Phobetus sloopi n. sp.

Indistinguishable from *comatus* Lec. by external characters but may be at once placed by the oedeagus. The piceous sutural stripe of the elytra is usually not as evident.

Male. Small reflexed uncus on the inner side of the middle tibiae at the apex. Posterior tibiae with distal portion dilated so that the greatest width is sub-equal to the length of the first tarsal segment, spurs slender. Posterior tarsi longer than tibiae, first and second segments sub-equal in length. Antennal club distinctly longer than funicle. Length 13-15 mm.

Female. More robust. Middle tibiae simple. Posterior tibiae with distal portion strongly dilated with greatest width more than length of first tarsal segment, spurs dilated. Posterior tarsi equal in length to tibiae, first and second segments sub-equal in length. Antennal club as long as the funicle. Length 14-16 mm.

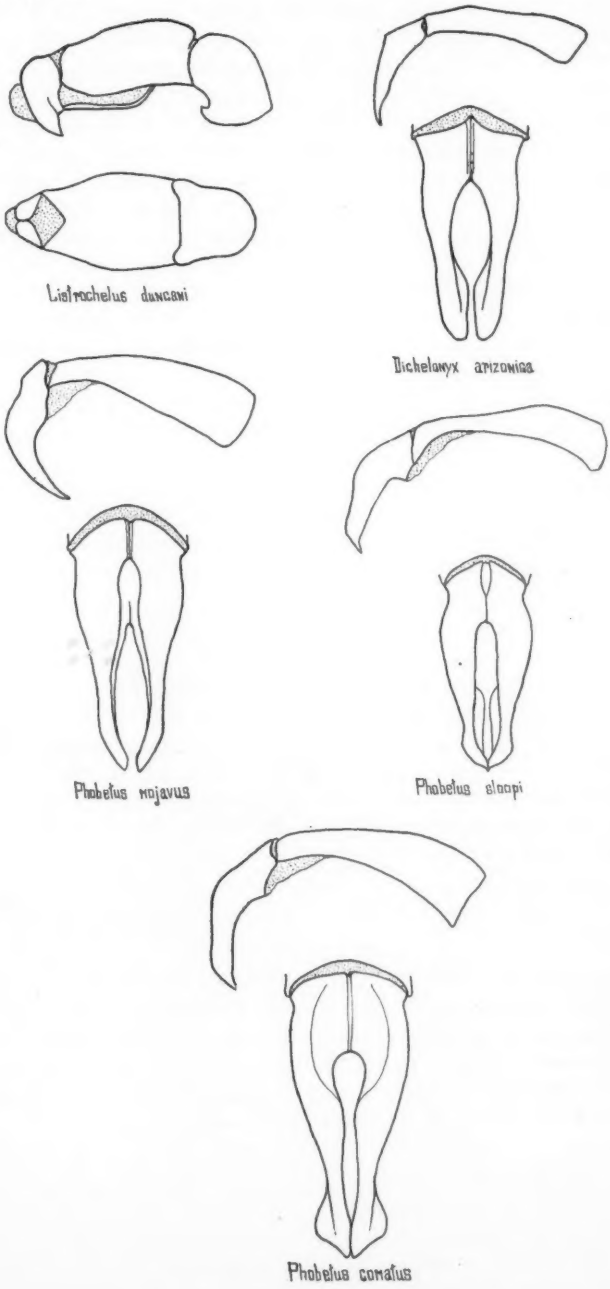
Holotype, male and *allotype,* female from Sierra Madre, California, April 1932. Numerous paratypes with same data.

All specimens collected at light traps in the early evening by Mr. Kenneth Sloop of Pasadena, California, to whom I take pleasure in dedicating this interesting addition to our fauna. A series of paratypes is in Mr. Sloop's collection.

Phobetus mojavus n. sp.

Oblong, rather slender, highly polished, pale yellowish testaceous, head

CAN. ENT. VOL. LXV. PLATE 8.



BARRETT—NEW N. AM. SCARABAEIDAE.

piceous at base lighter anteriorly, pronotum dark brown anterior of the frontal margin and with a distinctly impressed piceous spot near the sides. Head fimbriate, disk glabrous, clypeus finely and sparsely punctate, front between the eyes coarsely and densely punctate with the punctures confluent. Pronotum fimbriate with long pile, disk glabrous, lateral margins obtusely subangulate at the middle, hind angles rounded, disk finely punctate with punctures separated by three or four times their own diameters. Elytra with sparse long pile near the base, sutural striae distinct and complete, the other striae represented by rows of fine closely placed punctures, intervals with coarser more widely spaced punctures. Under surface of body densely covered with long white pile.

Male. Small reflexed uncus on the inner side of the middle tibiae at the apex. Posterior tibial spurs slender, lower distal edge of tibiae prolonged two-thirds the length of the lower spur forming a pseudo-spur. Posterior tarsi with second segment distinctly longer than first segment. Antennal club slightly longer than funicle. Length 14-16 mm.

Female. Middle tibiae simple. Posterior tibial spurs broad, lower distal edge of tibiae prolonged but slightly. Posterior tarsi with first and second segments sub-equal in length. Antennal club shorter than funicle. Length 17 mm.

Holotype, male and *allotype,* female from Ricardo, California, which is located in Red Rock Canyon about 30 miles north of Mojave on the Mojave Desert. Taken while mating May 9, 1927. Two paratypes with dates March 19 and April 3, 1932. Taken at light near Mojave, California.

Dichelonyx arizonica n. sp.

Rather robust, piceous, elytra bronzed with dark greenish luster, without pale side margins. Head densely not deeply punctate, clypeal suture distinct; clypeus moderately reflexed, angles rounded; antennae of nine segments, scape dark brown; maxillary palpi with terminal segment widened apically, truncate. Pronotum narrower than the elytra at base, widest before the middle, feebly sinuate posteriorly, hind angles obtuse, surface closely punctate, without trace of median longitudinal sulcus, basal marginal line faint. Elytra at base finely punctate with punctures separated by three times their own diameters, remaining surface of elytra coarsely rugose. Posterior tibial spurs unequal, slender, pointed, upper spur about twice the length of lower.

Male. Slender. Antennal club slightly longer than funicle. Length 8-10 mm.

Female. Robust. Antennal club shorter than funicle. Length 8-11 mm.

Holotype, male; *allotype,* female; taken during June in the White Mts., Arizona. Paratypes, a male and female with same data in the cabinets of Mr. Douglas K. Duncan of Globe, Arizona.

In Fall's key this species will run to *backii* Kirby from which it may immediately be separated by the antennae of the male and the color and sculpturing of the elytra.

Mr. Frank H. Parker of Tucson, Arizona, collected the specimens and has kindly furnished the following information concerning their capture: "This species was taken at Hannigan's Meadow some forty miles S.S.E. of Springerville, Ariz., where they were flying at dusk. They were attracted to my white bed tarpaulin.—there is a heavy stand of Douglas fir where these were taken——."

STUDIES IN THE ELATERIDAE, I (COLEOP.)*

BY W. J. BROWN,
Ottawa, Ontario.

Aeolus Esch.

The North American species of this difficult genus are very poorly known. The names of our species, as listed in Leng's catalog, are in need of some revision. One name, *mellillus* (Say), has escaped the attention of all authors but is valid for the common *Drasterius elegans* of our literature. The catalog lists most of our species in the genus *Drasterius*. Two species, listed as North American with doubt, should be rejected from the catalog. These are *elegans* (Fab.), a species of the West Indies, and *circumscriptus* (Germ.). The latter was described from "America boreali", but Champion's study (1897, Biol. Cent. Am. Coleop. III (1), 368) of the probable type indicates that it is a common species not known from north of Mexico.

The Canadian forms of *Aeolus* may be arranged as shown by the following table. I can separate them by color characters only. Because of their distribution and certain variation noted below, I am inclined to consider them geographical races of one species.

1. Dorsum bicolored, the pronotal black spot elongate-oval or lanceolate, each elytron with an anterior black spot which never attains the suture or the posterior black band; eastern ..... *mellillus mellillus* (Say)

   Dorsum more or less bicolored but with the black markings more extensive; the pronotal black spot usually broadly oval; anterior spot of each elytron always joined to the posterior black markings, these black areas sometimes extended over the disk; western 2

2. Pronotal spot occupying not more than half of the pronotal area; black markings of the elytra less extensive, not attaining the scutellum or elytral base. B. C. and Alta. ..... *mellillus comis* (Lec.)

   Pronotal spot usually occupying more than half of the pronotum; black markings of the elytra usually attaining the scutellum, often extending to the lateral margin anteriorly and to the basal margin; Sask. and Man..... ..... *mellillus marginicollis* (Horn)

Aeolus mellillus mellillus (Say).

Elater dorsalis Say, 1823, Jour. Ac. Nat. Sci. Philadelphia III, 167; Lec. ed. II, 108 (*nec* Payk., 1800, Faun. Suec. III, 4).
Elater mellillus Say, 1836, Trans. Am. Philos. Soc. VI, 173; Lec. ed. II, 608.
Drasterius elegans auct (*nec* Fab., 1792, Ent. Syst. I (2), 230).

This is represented in the National Collection by fifty-two specimens from various localities in Ontario including Ottawa, Southampton, and Point Pelee, and from Ohio, Pennsylvania and Lawrence, Kansas. The series shows very little variation in the size of the black spots. This typical subspecies is well illustrated in Blatchley's "Coleoptera of Indiana" and in numerous economic publications.

Aeolus mellillus comis (Lec.)

Monocrepidius comis Lec., 1853, Trans. Am. Philos. Soc. X, 484.

I have five specimens of this subspecies from Lethbridge, Alta., and six from Chilcotin, Vernon, and Barnhard Vale, B. C. It was described from San Francisco and San Jose, California. In the Lethbridge specimens and in one from Chilcotin, the pronotal spot is no larger than in typical *mellillus*. In all,

*Contribution from the Division of Systematic Entomology, Entomological Branch, Dept. of Agric., Ottawa.

however, the elytral spots are larger and join on each elytron to form a vitta which approaches or joins the suture anteriorly. Several specimens from Manitoba which I am including with *marginicollis* approach *comis* very closely.

Aeolus mellillus marginicollis (Horn.)

Drasterius marginicollis Horn, 1871, Trans. Am. Ent. Soc. III, 308.

I have twenty-two specimens from Saskatoon, Sask., ten from Stony Mountain, Baldur, Stockton, and Westbourne, Man., and two from Salt Lake, Utah. In most of these, the pronotal spot is very broadly oval, and the elytra are black with the extreme apex pale and with the lateral margins narrowly pale except near the apex. The basal margin of the elytra is pale in about half the specimens, and the prothoracic venter is usually pale. The black areas are not as sharply delimited as in typical *mellillus*. In one specimen from Westbourne and in one from Salt Lake, the entire body except the pronotal angles and some small areas on the prothoracic venter are black. The Saskatoon specimens do not vary greatly, but some of those from Manitoba tend to approach *comis*. Two from Stony Mountain do not differ from *comis*. The darker specimens of *marginicollis* frequently have a narrow, indistinct blackish band near the middle of the pronotal side margins. The sub-species was described from "Oregon."

Ampedus melanotoides n. sp.

Female. Length 10.5 mm.; width 3 mm. Cuneate; reddish-brown, the appendages concolorus, the head slightly darker. Vestiture yellow, fine, inclined.

Head very closely, not coarsely punctate. Antennae attaining the apices of the posterior pronotal angles; the segments more elongate than usual, the second twice as long as wide and three-fourths as long as the third, the third segment subcylindrical and four-fifths as long as the fourth, segments four to ten inclusive about twice as long as wide.

Pronotum including the posterior angles as long as wide; the sides subparallel in basal third, moderately arcuate and converging anteriorly; the posterior angles not diverging, each with a single strong carina. Disk closely punctate; the punctures at middle deep, not coarse, separated by distances slightly less than their own diameters; the punctures becoming coarser, closer and subumbilicate on the sides and dense near the lateral margins.

Elytra not parallel but narrowed posteriorly from the base, feebly so in basal two-thirds, more strongly so apically; intervals not strongly but distinctly subrugose.

Ventral surface closely punctate throughout, the punctures rather fine at middle, coarse and very close on the sides. Secondary sexual characters not evident.

Holotype—♀, Eastern Ontario, 1884; No. 3402 in the Canadian National Collection, Ottawa.

Allotype—♂, State College, Pa., April 18, 1910.

Paratype—1 ♀, Pt. Pelee, Ontario, June 3, 1929, (G. S. Walley).

The paratype and allotype measure 9.5 and 10 mm. respectively and show no variation worthy of note. On account of its color and form, the species closely resembles some species of the genus *Melanotus* Esch. In Leconte's table (1884, Trans. Amer. Ent. Soc. XII, 8) it traces to *manipularis* Cand. and is very probably the species so identified by Leconte. The true *manipularis*, however, is a black, parallel species closely allied to *luctuosus* Lec. The present species is

strongly characterized by the elongate antennae composed of very slender segments, the uniformly brownish color, and the cuneate body form.

Ampedus laurentinus n. sp.

Male. Length 7.5 mm.; width 2.3 mm. Subparallel; black, shining, the antennae concolorous, the legs very dark brown, the tarsi slightly paler. Vestiture black, that of the dorsum black and suberect.

Head very closely punctate, the punctures moderately coarse, subumbilicate. Antennae stout and strongly serrate, attaining the bases of the posterior pronotal angles, the second segment as wide as long and two-thirds as long as the third, the third segment feebly triangular, half as wide as and two-thirds as long as the fourth, the latter distinctly longer than wide, segments five to nine inclusive as wide as long, their outer angles rounded and not acute.

Pronotum including the posterior angles as long as wide; the sides feebly and evenly arcuate throughout, not more strongly so near the apex, feebly sinuate before the posterior angles, the latter feebly diverging and distinctly carinate. Punctures of the disk separated by their own diameters or a little more and moderately coarse at middle, closer, coarser, and distinctly umbilicate on the sides, very close near the lateral margins.

Elytral subparallel in basal two-thirds; the intervals feebly subrugose. Prosternum and episterna of the prothorax not coarsely, rather sparsely punctate; the metasternum and abdomen more finely, closely punctate. Secondary sexual characters not evident.

Holotype—♂ Fairy Lake, Hull, Que., June 1, 1927, (W. J. Brown); No. 3403 in the Canadian National Collection, Ottawa.

Allotype—♀, Hastings Co., Ont., June 4, 1903, (Evans).

Paratype—1 ♂, Sudbury, Ontario, 1889.

The paratype and allotype measure 7.6 and 8 mm. respectively. The species is strongly defined by the short, strongly serrate antennae, the black vestiture, the umbilicate pronotal punctures, and the pronotal form. It is most likely to be confused with *nigrinus* Payk.

Ampedus luteolus (Lec.)

Elater pusio Lec. et Cand. (nec Germ.)

Study of the original descriptions shows that *Ampedus pusio* Germ. is a synonym of *Elater areolatus* Say. The name *luteolus* Lec. then becomes valid for the species considered *pusio* Germ. in our literature. Both *areolatus* and *luteolus* occur in southern Ontario; the latter, however, seems to be quite rare.

Ampedus varipilis (Van Dyke)

Elater varipilis Van Dyke, 1932, Proc. Cal. Ac. Sci. XX, 306.

To this species I refer specimens from the collection of Mr. A. T. McClay taken as follows: 1, Meadow Valley, Plumas Co., Calif.; 1, Glacier Pt., Calif.: 1, Myers, Calif.; 1, Tahoe, Calif.: 2, Fallen Leaf Lake, Lake Tahoe, Calif.; 14. Sequoia National Park, Calif. These specimens agree well with the original description of the species except in two particulars. In some of the specimens, the apical black spot of the elytra is only feebly emarginate at the suture on its anterior margin. In most of them, the pale area penetrates the black spot more deeply along the suture, but in none of them does it penetrate the black spot for a distance greater than one-third the length of the latter. In all of the specimens, the hairs of the pale part of the elytra, except a few on the extreme base, are black, not yellow as suggested by the description. However, I believe

these specimens are typical examples of *varipilis,* the type of which is from Strawberry Valley, Eldorado Co., Calif. They have the pronotal punctures separated by distances equal to or less than their own diameters at middle and much closer on the sides.

In addition to the specimens noted above, there are six specimens, taken at the same time as the others at Sequoia National Park, in which all of the pronotal hairs are yellow and one with similar data in which the pronotal disk is covered with intermixed yellow and black hairs. These differ by no other characters from the typical examples, and I refer them to the species. In Dr. Van Dyke's key, they fall with *apicatus* Say, in which the pronotum is less closely punctate and the elytral hairs are all yellow.

Examples of *varipilis* from British Columbia show the same variation described above. However, they differ constantly from the Californian examples and are described below.

Ampedus varipilis columbianus n. subsp.

Male. Differs from typical *varipilis* only in the pronotal sculpture and in the form of the elytral black spot. Length 9.2 mm. Hairs of the dorsum, except a few on the bases of the pronotum and elytra, black. Antennae not attaining the apices of the posterior pronotal angles. Pronotal punctures not close, separated at middle by distances from one or two times as great as the diameters of the punctures, a little closer near the lateral margins but there many of the punctures separated by distances equal to their own diameters, sparser near the base. Elytra with the black spot slightly smaller than in typical *varipilis* and penetrated along the suture by the pale area a distance equal to half its length.

Female. Antennae a little shorter.

Holotype—♂, Creston, B. C., May 14, 1928, (G. Stace Smith); No. 3466 in the Canadian National Collection, Ottawa.

Allotype—♀, same data, May 11, 1929.

Paratypes—with pronotal hairs black, 5, same data, May 30, 1929, and May 3, 5, 6, and 7, 1931; 1, same locality, May 24, 1929, (Betty Smith); 2, Trinity Valley, B. C., Aug. 21, 1929, and May 10, 1930, (J. R. Howell); 1, Vancouver, B. C., May 30, 1931, (H. B. Leech); 1, Enderby, B. C., June 2, 1921; 1, Hotel Lake, Pender Harbor, B. C., June 3, 1926, (G. R. Hopping); 1, Nelson, B. C., June 1, 1924, (R. D. Bird); 1, North Vancouver, B. C., June 23, 1913, (A. Gibson); 1, Vancouver Island, (Taylor); with pronotal hairs yellow, 6, Creston, B. C., May 11, 1928 and 1929, May 1 and 12 and June 20, 1931, (G. Stace Smith); 1, Copper Mountain, B. C., March 29, 1931, (G. Stace Smith); 1, Trinity Valley, B. C., June 28, 1929, (J. R. Howell); 1, Kaslo, B. C., June; with pronotal hairs black and yellow intermixed, 2, Creston, B. C., May 28, 1926, and May 17, 1931, (A. A. Dennys and G. Stace Smith).

The paratypes measure from 8 to 10.6 mm. in length and show the same variation in the color of the pronotal hairs as is noted above for typical *varipilis.* The elytral black spot shows some variation, but it is usually slightly smaller and more deeply emarginate at the middle of its anterior margin. In most of the specimens, the pale area penetrates the black spot a distance greater than half the length of the latter, and each sutural interval is rufescent nearly or quite to the apex.

Ampedus quebecensis n. sp.

Male. Length 8 mm.; width 2.3 mm. Subparallel; surface shining but not highly polished; black, the antennae and femora very dark brown, the tibiae and tarsi reddish-brown; elytra brownish-red, the entire apical third covered by a subcordiform black spot. Vestiture of the entire dorsum black, that of the pronontum short but coarse and suberect; vestiture of the venter reddish-yellow.

Head with very close, moderately coarse, subumbilicate punctures. Antennae short and moderately stout, attaining the bases of the posterior pronotal angles, the second segment as wide as long and two-thirds as long as the third, the third segment very feebly triangular, half as wide as and two-thirds as long as the fourth, the latter almost twice as long as wide, segments five to nine inclusive two-thirds as wide as long, their outer angles broadly rounded and not acute.

Pronotum including the posterior angles as long as wide; the sides moderately and evenly arcuate throughout, not more strongly so near the apex, feebly sinuate before the posterior angles, the latter feebly diverging and strongly carinate. Punctures at middle in anterior half not coarse, subumbilicate, separated by distances about equal to their own diameters, the punctures fine and less close in posterior half but becoming coarse, umbilicate, and closer on the sides and dense near the lateral margins.

Elytra parallel in basal two-thirds; the intervals very distinctly subrugose. Prosternum and episterna not coarsely, moderately closely punctate. Abdomen finely, very closely punctate. Secondary sexual characters not evident.

Holotype—♂, Seven Islands, Que., July 4, 1924, (F. W. Waugh); No. 3404 in the Canadian National Collection, Ottawa.

Allotype—♀, same locality, June 8, 1929, (W. J. Brown).

The allotype measures 8.2 mm. and is quite similar to the male. The species is strongly characterized by the characters of the vestiture, antennae, and the color. It differs from *apicatus* Say, the only eastern species with which it might be confused, by the darker elytra with larger black spot, the black vestiture, the less shining surface, and the feebly triangular antennal segments. In *behrensi* Horn, the vestiture is longer and the other characters are much as in *apicatus*. In size and form, the black elytral spot of the present species is similar to that of *affinis* Lec.

Ampedus evansi n. sp.

Male. Length 11.5 mm.; width 3.7 mm. Subparallel; strongly shining; black, the antennae and legs very dark brown, elytra pale reddish-brown. Vestiture reddish-yellow, inclined.

Head closely, rather finely punctate. Antennae rather slender, not quite attaining the apices of the posterior pronotal angles; the second segment slightly longer than wide, two-thirds as long as the third; the third segment feebly triangular, half as wide as and two-thirds as long as the fourth; segments four to eight inclusive about two-thirds as wide as long, their outer angles rounded and not acute.

Pronotum including the posterior angles as long as wide; the sides straight and feebly converging anteriorly in basal two-thirds, moderately arcuate near apex, not sinuate before the posterior angles, the latter feebly diverging and strongly carinate. Punctures at middle of disk not coarse, separated by distances

a little greater than their own diameters, sparser near the base, the punctures becoming a little coarser, close, and feebly subumbilicate on the sides and very close near the lateral margins.

Elytra parallel in basal two-thirds; intervals sparsely punctate, not subrugose. Ventral surface moderately coarsely, very closely punctate. Sexual characters not evident.

Holotype—♂, Sudbury, Ont., June 18, 1892; No. 3405 in the Canadian National Collection, Ottawa.

Allotype—♀, same locality, May 30, 1889, (J. D. Evans).

Paratypes—1♂, 2♀, same locality; 1♀, Ft. Coulonge, Que., June 3, 1918, (J. L. Beaulne); 1♀, Bathurst, N. B., July 6, (J. N. Knull); 1♂, Constance Bay, Ont., October 5, 1932, (W. J. Brown).

The allotype and paratypes measure from 10.3 to 12.3 mm. The species has been confused with *vitiosus* Lec. in collections. In the latter, the elytra are yellowish rather than reddish; the thorax is coarsely and very closely punctate at middle, the punctures becoming coarser, dense, and umbilicate on the sides; the antennae are shorter and much more strongly serrate, the intermediate segments being as wide as long. On account of its color and size, the present species is not likely to be confused with others from the east. However, it is closely allied to the western *phoenicopterus* Germ., agreeing with the latter in color, antennal form, and scupture of the ventral surface. In *phoenicopterus* the punctures of the pronotum are a little coarser and closer throughout, and the vestiture of the elytra is black.

In three of the paratypes, each elytron is marked with a dark spot which is not sharply delimited and which extends over the apical two-fifths of the elytron. There is a faint suggestion of this spot in the holotype. These specimens resemble somewhat the more faintly marked examples of *Elater bimaculatus* Van Dyke. In the latter species, the spot is smaller and subapical, the body is more elongate, and the hairs of the elytra are black.

Megapenthes Kies.

Under the name *Megapenthes stigmosus*, three forms worthy of names are confused in collections. One of these is the true *stigmosus* Lec. Another is *caprella* Lec., a strongly characterized species and not a color form or synonym of *stigmosus* as considered by recent authors. The third form differs strikingly from *caprella* in color but seems to agree with the latter in all other characters. On this account I am inclined to consider it only subspecifically distinct from *caprella*. These forms are all black with yellow markings. The confusion is probably due to their variation in color, much of which is sexual. They are compared in the following table and description:

1. Prothoracic flanks with well defined, very distinct punctures. . .*stigmosus* Lec.
   Prothoracic flanks without punctures, feebly subgranulate. 2
2. Male (antennae attaining apices of posterior prothoracic angles) without a sublateral spot behind the humeral umbone. Female (antennae much shorter) with yellow markings at basal third of elytron which extend forward upon the second interval, with a basal and post-humeral spot which are frequently imperfectly or not joined, these basal markings often fused but never forming a simple, C-shaped lunule. . . *caprella caprella* Lec.
   Male with a sublateral spot behind the humeral umbone, the spot frequently

joined to others to form a lunule. Female elytron with a broad, simple, C-shaped lunule at base .....*caprella californicus* n. subsp.

Megapenthes stigmosus (Lec.)

Elater stigmosus Lec., 1853, Trans. Am. Philos. Soc. X, 472.

Moderately elongate, obtusely pointed posteriorly. Antenna surpassing the posterior pronotal angle by a distance equal to the length of the apical segment in the male, just attaining the apices of these angles in the female; the segments feebly triangular, the terminal segment fully three times as long as wide. Head with its punctures well defined and very densely placed. Punctures of the pronotal sides shallow but distinctly defined; those of the prothoracic flanks strongly defined, very distinct. Posterior pronotal angles, viewed from below, only slightly produced posteriorly.

Color only slightly variable; the pronotum never maculate; elytron with an elongate basal spot which never extends within the second stria, a small elongate spot at basal third on the third and fourth intervals, and an oblique sublateral spot behind the humeral umbone; these spots frequently joined together in both sexes, usually a little smaller in males than in females but never greatly reduced; a slightly transverse spot at apical fourth.

Male genitalia with each lateral lobe squarely truncate at apex, the lateral tooth forming the outer apical angle of the lobe.

The species was described from Lake Superior. It is represented in the material before me by sixteen specimens from Bathurst and Boiestown, N. B., Irondale, Sudbury, and Burks Falls, Ont., Aweme and Riding Mountains, Man., Yankee Bend, Sask., and Salmon Arm, B. C.

Megapenthes caprella caprella (Lec.)

Elater caprella Lec., 1857, Rept. Expl. and Surv. Miss. to Pac. XII, pt. 3, 47.

Body more elongate and more pointed posteriorly than in *stigmosus*. Antennae attaining the apices of the posterior pronotal angles in the male, failing to attain the apices by a distance equal to the length of two segments in the female; the segments strongly triangular, the terminal segment about twice as long as wide. Punctures of the head poorly defined, less dense than in *stigmosus*. Punctures of the pronotal sides poorly defined; the prothoracic flanks without punctures, feebly subgranulate. Posterior pronotal angles, viewed from below, strongly produced posteriorly.

Color differing in the sexes. *Male*—Pronotum usually immaculate, rarely with a spot on the posterior margin within the carina of the angle; elytron with the basal spot triangular, very little larger than the scutellum, never prolonged; a much smaller spot at basal two-fifths on the third or third and fourth intervals, this frequently wanting, rarely extending onto the second interval; never with trace of a sub-lateral spot; a spot at apical fourth usually subequal in size to the basal spot, sometimes reduced, absent in one specimen. *Female*—Pronotum with a yellow spot on the posterior margin, this usually extending to the lateral margin, rarely reduced and indistinct; elytron with a basal spot and a discal spot at basal two-fifths, these larger than in the male, the discal spot always extending onto the second interval and freqently attaining the suture, a sublateral spot always present behind the humerus, these three spots usually joined together; the spot at apical fourth larger than in the male.

Male genitalia with each lateral lobe obtusely subangulate at apex, the

lateral tooth situated just behind the apex, the median lobe narrower than in *stigmosus*.

The species was described from "Shoalwater Bay, Oregon." The above description is based on sixty-four specimens from the Queen Charlotte Islands, Vancouver Island, and various localities on the mainland of British Columbia. Horn (1871, Trans. Am. Ent. Soc. III, pl. IV, figs. 10, 11) has figured both sexes of the species. His figure of the female is properly labeled *caprella;* that of the male is labeled *stigmosus*.

In only two of the thirty-eight females of typical *caprella* before me does the discal spot of the elytron fail to extend anteriorly along the second interval. This extension is strongly developed in all of the specimens in which the basal and sublateral spots are joined together.

Megapenthes caprella californicus n. subsp.

Male. Pronotum with a distinct spot on the posterior margin within the carina of the angle. Elytron with a basal lunale formed by the fusion of a basal spot situated between the humeral umbone and the second stria, a sublateral spot equal in size to the basal spot and situated behind the umbone, and a small transverse spot situated on the third and fourth intervals at basal third; a small transverse spot at apical third. Other characters as in typical *caprella*.

Female. Pronotum with the yellow spot on each side extending to the lateral margin. Elytra as in the male but with the basal lunule wider and the apical spot larger, the yellow markings extending only to the second interval. Other characters as in typical *caprella*.

Holotype—♂, Sequoia National Park, California, August 2, 1929, (A. T. McClay); No. 3455 in the Canadian National Collection, Ottawa.

Allotype—♀, same data.

Paratypes—2♀, same data; 7♂, 1♀, Riverton, California, July 6, 7, and 17, 1931, (A. T. McClay and E. C. Zimmerman); 1♂, Myers, California, July 3, 1930, (A. T. McClay); 1♂, Ben Lomond, California, June, 1932, (L. W. Saylor).

The specimens measure from 6 to 7.5 mm. in length. In one of the males, the pronotal spots extend to the lateral margins. In five the elytra are maculate as in the holotype; in the others the basal lunule is more or less broken into three spots. In one the sublateral spot is reduced and indistinct. The females are more constant in color. In one the discal markings extend onto the second interval, but in none is there a tendency for these markings to be extended anteriorly along this interval to partially enclose a black discal area. In all but one, the basal, sublateral, and discal spots are broadly joined to form a wide, C-shaped lunule; in one the entire basal third of each elytron is yellow.

Paratypes are deposited in Mr. McClay's collection.

Megapenthes dolosus n. sp.

Male. Length 11.3 mm.; width 3.3 mm. Form and color as in *tartareus* Lec.; black, the legs and three basal segments of antennae dark red; the body rather strongly shining; the entire dorsum clothed with coarse, closely placed, suberect, black hairs.

Head moderately coarsely, densely punctate, the narrow ridges between the punctures polished and not alutaceous; front moderately concave from side to side, its anterior margin strongly and almost evenly arcuate, distinctly elevated

above the plane of the labrum. Antennae strongly serrate, clothed with long hairs, surpassing the posterior pronotal angles by a distance subequal to the length of the apical segments; segments two and three equal in length, together two-thirds as long as the fourth, the intermediate segments scarcely longer than wide.

Pronotal width equal to the length of the median line, the sides straight and parallel except near the angles; the posterior angles diverging moderately, very strongly carinate. Pronotal sculpture uniform throughout, like that of the head, the median line rather strongly impressed on the basal declivity.

Elytra feebly narrowed from the humeri; the intervals rather closely punctate, not rugose. Prothoracic venter moderately coarsely, very closely punctate, the punctures less dense than on the pronotum, without alutaceous sculpture; the anterior margin of the prosternal lobe very feebly arcuate; the intercoxal process wider than in *tartareus*, slightly narrower than in *horni* Leng, channeled. Metasternum and abdomen polished, not alutaceous, finely and closely punctate.

Holotype—♂, Camp Potwisha, Sequoia National Park, Calif., July 16, 1931, (A. T. McClay); No. 3442 in the Canadian National Collection, Ottawa.

Paratypes—1 ♂, same data; 1 ♂, Sequoia National Park, Calif., June 15, 1929, (A. T. McClay).

Superficially this species bears perfect resemblance to *tartareus*. By structure, it falls close to *horni* on account of the short antennae, elevated front, and the feebly arcuate margin of the prosternal lobe. In the latter, the head and pronotum are dull on account of very dense alutaceous sculpture on the intervals between the punctures. The ventral surface except for the prosternum is finely alutaceous and dull, not strongly shining as in *dolosus*. In *horni* the legs are blackish and the vestiture is shorter and less conspicuous. In the genitalia of both these species, the lateral tooth of each lateral lobe is situated well behind the apex. In *horni* the margin between the tooth and the apex is perfectly straight; in *dolosus* the margin is broadly, arcuately emarginate. The paratypes measure 10.7 mm. and 12.5 mm. in length.

FURTHER NOTES ON APHILANTHOPS QUADRINOTATUS ASHMEAD (HYMENOP.)

BY CHARLES H. HICKS,
University of Colorado.

This wasp has been reported* capturing as prey the western harvester or mound-building prairie ant, *Pogonomyrmex occidentalis* (Cresson), and carrying it on its sting or on the posterior end of the abdomen to its nest. During the month of September, 1932, the writer was again privileged to study this wasp and to make some further observations. The method of carrying the prey was witnessed at Roggen, Colorado, and also near Boulder, at Owens Lake. The latter nesting site was at the same location as that from which the first report was given. The method of carrying the prey is unusual and seemingly rare among wasps and it was therefore with much pleasure that it was shown to, observed, and verified by Mr. Maurice T. James of the Biology Department of the University of Colorado.

Many nesting females of this wasp were found digging tunnels and pro-

*Hicks, Charles H. **Aphilanthops quadrinotatus** Ashmead, a Wasp which carries her Prey on her Sting. Canad. Ent. Vol. LIX, pp. 51-55, 1927.

visioning cells in sand banks, to and from which they were flying with regularity. The stalking and capture of prey was observed a number of times. It was found that the wasp would capture an ant at the mound, would dig into a hill to find one, or pounce upon a worker walking along at some distance from the nest. The first manner of capture was the most frequent; the second and third, apparently about equal in the number of times observed.

On September 15th, at Owen's Lake, two aggressive wasp huntresses were found attacking and taking ant workers at a large and active nest situated on the top of a small knoll. The time was a little past noon, with a clear sky and the weather quite warm, although not excessively so. These wasps were observed for some time and many captures witnessed. A wasp would often alight, on a return from the nest, at the edge of the bare area about the hill, starting her careful maneouvers from this point. Her poise and the position of every part of her body denoted attention and alertness. Her antennae were held forward, slightly at right angles to her body, and her eyes appeared intently fastened upon her prey as she seemed to watch or follow their every movement. She would suddenly rush in after an ant as it hurried towards its tunnel, following it closely until she was in a favorable position to jump upon it, or until, as more often was the case, it could successfully evade her and reach the shelter and protection of the nest. The first ant receiving her attention would usually escape, the wasp turning to another and still others before attacking any one individual.

There seemed to be considerable hesitation, or possibly caution, on the part of the wasp, for this procedure was repeated a number of times in this and other specimens. Thus she might follow an ant up to its very disappearance into its tunnelway. Foiled in this capture, she would then quickly turn to or go after another. At one time an ant instead of running away, turned upon the wasp, the latter retreating. A few times two wasps, chancing to be on the mound at the same time, met each other face to face. This did not precipitate an attack, but resulted only in each turning to her own individual task.

It seemed that the ants, for the most part, hurried away with increased speed when the wasps were about. But eventually and in a comparatively brief time, a period appearing longer because of the rapidity of action than it really was, the wasp would throw herself upon or grab an ant, overcome and sting it, impale it upon her sting and be quickly away with it to the nest.

The attack and stinging of the ant is a quick happening, lasting but a few seconds. It varied at this time and place from 8 to 14 for the most part, although a few may have been shorter and occasionally one much longer. After the wasp became "nerved" to the point of attack or was in a position for the act, the first rapid movements escaped detailed observation. Soon the wasp was seen to be biting or grasping the head of the ant with her jaws, possibly the hold assisted by her legs, while the captive appeared to be actively struggling and attempting to get away by biting, kicking and stinging.

It seems highly probable that the ant continues to try to sting the wasp, and probably does so feebly, before the latter may have reached the nest or the effects of her stinging may have weakened the prey. This would possibly account for the repeated rearrangement of the ant by the wasp, an act which has been executed on several occasions and after the actual capture has taken place. It occurs sometimes before the wasp begins her flight to the nest, or when she

is on the way to the nest and finally, when she is at or near to the nest. The sudden stopping to quieten or re-arrange the prey for carrying has been noted again and again, although this may not be necessitated at each and every capture. The wasp, at such a time, twists her head back to the impaled ant and appears to use her jaws in quieting, re-arranging, or in better holding it.

Specimens have been observed a few times capturing prey in the open and away from the ant hill. In one instance, a provisioning wasp took a worker which had strayed near to the entrance to her nest.

Instances have been found where the wasp dug or forced her way into the mound itself and there captured and overcame her victims. One wasp particularly, persistently and periodically engaged in this activity. Similar action was noted in this and other individuals on the occasion of other trips to the field. In the forenoon of a mid-September day, a female was found and watched as she spent much time in digging a tunnel in a forced entrance into the nest of the ant. The tunnel was at first short and appeared to have been dug by the wasp. This was soon much enlarged, however, as she increased its length and size by her rapid work. The soil and small pebbles were kicked back by her fore legs, much after the fashion employed in her usual nest digging. After backing out with the refuse she would immediately re-enter for more, repeating again the sequence. Later, with an opening cleared, she emerged head-first with her ant carried on her sting. Captures were then made in quick succession, with an occasional longer period between them when more digging caused her delay.

It was thought at first that this might be a small and weak colony of ants and that this fact might afford a logical reason for the seemingly fearless invasion and continued success of the wasp's attack. But further observations and subsequent diggings into the nest did not bear this out. The number of individuals comprising the colony in this hill did appear to be smaller than that of some other nests in the territory but hardly few enough to warrant such bold and continued effrontery on the part of the wasp. The ants were found at times, numerous and active about the hill.

The time spent in making an entrance into the nest and a capture at the hill, after the tunnel had been opened, varied from 16 seconds to 3 minutes and 5 seconds. In the brief time of 16 seconds the wasp did no digging and met the ant in the tunnelway, immediately attacking and overcoming it there. The longer periods, which often included some time spent in digging or in searching deeper within for the prey, were the more usual.

A wasp bringing prey to a nest in a continuous period of observation from 11:23′45″ to 11:31′45″ A. M. brought 8 ants, or an average of one each minute. Thus within the period of 60 seconds the wasp flew from the nest to the ant territory, located and captured an ant, returned with it to her nest, deposited it in a cell, came out and was ready for another journey to the hunting territory. It was not known, in this instance, where the wasp was getting her prey but it must of necessity have been near at hand. This wasp was working much more rapidly than the one reported in the paper previously referred to (Hicks, 1927).

Within an area 2 by 4 feet, 10 nests of *A. quadrinotatus* were marked and counted. They had been dug in fine sand under apparently normal if not optimum conditions and were as numerous as any found in an area of like size at this time, at or near Boulder. An exceedingly large number of potential nesting sites were

entirely free from the insect. This and other facts, an important one being that involving a nearly continuous seasonal and a very abundant supply of prey, leads to certain questions. Why is this wasp not found more commonly in season? Or again, why is its nesting period not longer or the number of generations a year larger?

These are questions I am unable to answer at present, a fact doubtless due in part at least to incomplete data at hand. But there must be some vital cause or forces acting to keep this insect in check, among which the following may be suggested: parasites, internal as well as external, not yet discovered; enemies of the mature insect; necessity for a rather exact combination of conditions of temperature and moisture for the developing young; an unbalanced sex ratio; hereditary complexes unfitting, to a certain extent, this insect to present day environmental conditions; or other causes. The fact that an animal is alive today and that the species continues to exist and reproduce in fair numbers, proves that it is and has been successful in its own particular way. And so it follows that the wasp, *A. quadrinotatus*, is a successful animal. But it would appear that it should be much more so, especially when one considers the advantages it already seems to possess over many nesting insects.

Earlier notes in regard to the habits of the wasp, the number of ant prey stored in a given cell, type of nest and cell, larva of the wasp, the cocoon and other facts, were reported in 1927. A few insects, taken in the field under circumstances which suggest them to be parasites or inquilines of this species, have been secured during the past nesting season. These are not here reported as definite parasites of *A. quadrinotatus* but they do bear watching. Each was taken after continued observation showed it to persist in its attentions to the nest or prey of this wasp. One was secured at Roggen, Colorado, on September 8th. It, as likewise the second insect, has been identified by Mr. M. T. James. The first species is a bombyliid fly, *Phthiria scolopax* O. S.; the second, a small tachinid fly taken near Boulder is *Senotainia* (? *trilineata* v. d. Wulp). The third parasite is a mutillid, *Dasymutilla sparsa* (Fox), kindly determined by Professor Clarence E. Mickel. It entered the tunnels and continued to remain at the spot where this wasp was working.

MAILED MONDAY, JULY 3, 1933